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"Malleable Iron Facts"

When an important army ordnance officer took it upon himself adversely to criticise the American malleable iron industry, we took up the cudgels in defence against what we deemed to be a totally unjustified attack, and wrote in this column an article to which we gave the caption "American Aggressiveness." Appreciating that the onlooker sees the most of the game, our colleagues in the American malleable foundry industry, through their trade association—the Malleable Founders' Society—have sent us a letter giving full approbation to our comments. This letter gives the following information: "(1) Over two years prior to our formal entry into the war, we inaugurated a programme of regular visits to the War Department in Washington and to the various arsenals. We then endeavoured to be helpful to the Ordnance and other War and Navy Departments, in acquainting them with the outstanding properties of malleable iron castings and in making for their most effective use; (2) The Malleable Founders' Society maintains a staff of shop practice engineers who spend their time visiting member companies, assisting in quality maintenance and improvement; (3) Better to acquaint military and naval personnel and manufacturers with the malleable casting possibilities, a bulletin, 'Malleable Iron Facts,' is published and (4) you may be interested to know we are engaged in the preparation of a malleable iron handbook." Yet this is an industry which has been assailed as unenterprising. Mr. James H. Lansing, the Development Engineer attached to the Malleable Founders' Society, who actually wrote the letter, was kind enough to enclose ten of the bulletins "Malleable Iron Facts." They are extremely attractive and are designed to emphasise the importance of relatively small components to the functioning of not only the major types of armaments, but to the overall war effort. Special stress is laid on toughness, machinability, and the possibility of replacing higher priority materials, whilst at the same time reducing machine shop man-hours. Extensive use is made of incisive illustration, and quotations from statesmen's slogans. A careful perusal of these bulletins shows some striking differences between British and American applications of malleable castings, and it is a matter for regret that we are not in a position to supply our American colleagues with a similar British publication, as such an action would be useful to them in extending the enlightened policy. As it is, we shall be happy to circularise the bulletins we have received to any firm or trade association who writes to us expressing interest. Whilst we are addressing ourselves primarily to the malleable iron founding industry, we believe that other sections of the industry should include in their post-war co-operative activities some type of enterprise designed to bring the potentialities of their products to the notice of the large-scale buyers. We do not for one moment suggest the slavish emulation of the American system as it may not be the best for the markets serviced by their British counterparts.

Federal officials in Cleveland, Ohio, have opposed plans which had been approved in Washington to spend $6,000,000 to build up the Cleveland area's production of malleable products, though adding to present plants and building new ones. Housing authorities indicated their opposition to the plan on the ground that there are not proper home units for additional workers who would be needed, while manpower officials added their protest, saying present foundries and forge shops are badly under-manned and cannot get the help they need.

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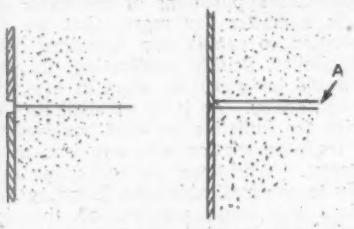
FOUNDRY INQUESTS—IV.

By "Coroner."

A particular type of trouble recently encountered was associated with a casting the whole of which was in the top box, the bottom being used only to locate and hold the cores in position. The trouble consisted of hollow places on top of the casting and, on investigation, it was revealed that the casting "ran out" during pouring. Why this should happen was not so apparent, as the boxes used had machined joints and the moulds were machine made. Further inquiries discovered that the pattern was mounted on a wood board and, although "bumpers" had been fitted to



each corner to keep the box slightly off the board and thus ensure a sand-to-sand joint, as on the left, the box had in fact bedded itself into the board. Thus a low joint was produced which, on casting, caused a fin of metal to form on the joint, as at A, on the right; as the whole of the casting was in the top box, the ferrostatic pressure combined with the fluidity of the metal—as the casting was bottom poured—burned away a piece of the box, causing the run-out. This board was overhauled and new and improved bumpers fitted, which served their purpose well, as no further trouble was experienced from this cause.

Identification of Ferrous Alloys

The American Tubular Elevator Company, Pittsburgh, has devised a unit called an "Identometer," which is an electrical instrument for identifying instantly and accurately, by the use of reference specimens, any ferrous alloy. A known sample is affixed to one of two clamps, and the unknown specimen to the other. When the two pieces of metal are brought into contact, the lighted indicator registers on an easily-read scale whether or not the two are of the same chemical analysis. The machine is about the size of a small cabinet radio and it can be used by personnel without exceptional skill. Provided with a reference specimen, it is possible by use of the Identometer to classify unknown pieces or lots of steel according to heats (identical analysis), grades (similar analysis), types (dissimilar analysis), heat-treatments (identical analysis with dissimilar structure), and composite types (two- and three-plys, clad metals, etc.). The Identometer can be used to identify metals in any stage of their working from the ingot onward if cooled to room temperature.

NOTES FROM THE BRANCHES

Wales and Monmouth

On November 6 the Branch received a visit from Mr. F. Dunleavy, of Newark, who presented a Paper on "Foundry Technique in Relation to Certain Pressure Castings." Members assembled at the works of Machine Products, Limited, Cardiff, where they were welcomed by the manager, Mr. Bailey. Following a tour of the works, tea was provided in the canteen and facilities afforded for the lecture, which was ably presented and illustrated with lantern slides.

There was a record attendance of above 80 members, including several visitors from other Branches. Mr. Dunleavy gave a very able discourse upon foundry problems to an interested audience.

Contributing to the discussion, Mr. A. E. McRae Smith congratulated Mr. Williams (Branch-President) and the lecturer upon having such a well-attended meeting on a Saturday afternoon, in spite of counter attractions.

Mr. R. J. Richardson proposed a vote of thanks to the lecturer, which was seconded by Mr. R. G. Williams (now of Bristol Branch). Both paid tribute to the value to the ordinary member of the discussion of practical foundry problems, such as the Paper stimulated.

Mr. Dunleavy, replying, expressed satisfaction with the attendance and the interest aroused.

London Branch (East Anglian Section)

The final meeting of the session was held in the Lecture Hall of the Central Library, Ipswich. In the absence of the President, Mr. F. Tibbenham, the Senior Vice-President, Mr. C. H. Kain, occupied the chair. Mr. F. V. Thomas, of Lake & Elliot, Limited, gave an address on "Some Aspects of Sand Control." It was announced that the new session would commence with the annual general meeting in March, 1944.

Mr. W. E. Mather, metallurgist, Davy United Engineering Company, Limited, was elected a member of the Institute of British Foundrymen, and not an associate member, as shown in our November 4 issue.

INDIAN BAUXITE

Writing in the "Journal of Scientific and Industrial Research," of the (Indian) Council of Scientific and Industrial Research, N. L. Sharma describes the occurrence and distribution of bauxite in India. The bauxite deposits of India are as large, and their quality as good, as those of any country in the world. The total resources of Indian bauxite are estimated at about 250,000,000 tons, the better grades of which are suitable to the manufacture of aluminium. The Aluminium Works at Alwaye (Travancore) have already started production of aluminium. The prospects for many more aluminium works in India are considered bright, for adequate raw material and power resources are available for making India self-sufficient with respect to this valuable metal.

A NEW TEST FOR MEASURING ENAMEL SLIP CONSISTENCY

By DR. G. T. O. MARTIN

Paper read at the Annual General Meeting of the Institute of Vitreous Enamellers in London

Introduction

In the vitreous enamelling of sheet steel, correct application and firing of the first coat of enamel, commonly known as the grip-coat or ground-coat, is important for the success of subsequent operations and the durability of the enamelware. The method of application almost universally employed is to dip the pickled and neutralised steel pieces into a thin slip, and allow them to drain, suitably supported. In order to obtain a uniform coating of enamel of correct thickness, the slip must be of suitable consistency and in practice the adjustment of this generally becomes quite critical. The usual custom is to mill the enamel as far as possible with standard mill additions and make the necessary adjustments at the dip tank by means of the water content of the slip.

In spite of much work that has been done in the investigation of the properties of enamel slip, the only form of test that has so far enjoyed the confidence of the practical enameller is the plate test, which gives a result directly related to what he requires to know about the enamel slip. In this test a square steel plate, of area 1 or 2 sq. ft., and treated exactly like the production pieces, is weighed, dipped into the enamel, drained, dried and re-weighed. The difference gives the weight of enamel picked up by the plate. A plate 2 sq. ft. in area will normally have a pick-up of between 70 and 90 grms. (2½ to 3¼ ozs.). This, of course, refers to the weight of enamel on both sides, the area figure referring to one side only. In actual practice the pick-up is controlled within fairly narrow limits. The figures given above represent the extreme range. For continuous operation with a conveyor it might be necessary to keep the figure within, for example, the limits of 82 and 85. No other type of test has so far been found simple, reliable and sensitive enough for the purpose.

Origin of the New Test

On the look-out for a rapid and simple method of testing grip-coat slip consistency in the laboratory, it was noticed, while stirring the enamel with a glass rod, that when approaching the correct consistency the rod, after draining, retained sufficient enamel to make it almost, but not quite, opaque. With practice, it was found possible to obtain a fair estimate of the consistency by this means. Naturally, a much better method was the use of a small glass plate, and this was soon in regular use as a first rough check on the enamel before a plate test as used in works practice.

Different consistency of the enamel produced a different degree of translucency of the dipped glass plate and the possibility of using the principle for actually measuring the enamel pick-up was considered. The aim was the preparation of a series of permanent standards, with which a freshly dipped glass plate could be compared, by transmitted light, and thus give at once a figure for the pick-up in weight per unit area.

Preparation of Standards

The preparation of these standards proved to be a matter of some difficulty, and even when success had been achieved in the laboratory, further troubles arose when the principles developed were applied to works use. The object was to make a layer of dried enamel, on a glass plate, appear wet when viewed by transmitted light. After many trials it was found that this effect could be achieved by partially wetting the dry enamel with oil. It is necessary for this oil to be colourless and free from volatile constituents, and most of the work was done with a proprietary brand of light oil found to be suitable. Later, the use of medicinal paraffin was suggested and this was found to fulfil the necessary requirements. In the first place, the oil was applied to the dried enamel in the form of a fine spray, but this was afterwards replaced by dipping in a solution of the oil in carbon tetrachloride, followed by evaporation of the carbon tetrachloride. By this means the oil was uniformly distributed throughout the dry enamel layer.

Some loss of strength of the enamel occurs after oil treatment and to prevent damage in use the treated plates were sandwiched between two clear glass ones, the edges being bound with adhesive strips in the manner used for photographic lantern slides. The glass used for both purposes was $\frac{1}{16}$ in. thick, and as near to colourless as it was possible to get. The size used was 12½ by 8 cm. (approximately 5 in. by 3 in.).

Regarding the application of enamel to the glass plates, this was done by dipping, and the most uniform application resulted from the usual works method of draining, *i.e.*, corner to corner, rather than edge to edge. The plates had to be clean and dry before dipping, to obtain uniform and repeatable results. Spraying produced a layer of enamel greatly different in appearance by transmitted light from that produced by dipping, and was soon abandoned for this reason, quite apart from its comparatively poor control of application thickness.

An effect which was noted in these first laboratory trials, but which did not prove very troublesome until works tests were undertaken, was the change in colour of the enamel on drying. The enamel slip being used at the time had a pinkish grey appearance by transmitted light, but the dried and oil-treated enamel had lost this pink colour, appearing more or

Enamel Slip Consistency Test

less blue-grey. It was found that this effect could be neutralised by incorporating a pink colouring material either in the oil or in the enamel slip used for making the standard plates.

Calibration of Standards

The pick-up of enamel by a smooth glass plate will not be the same as that by a pickled and neutralised steel plate. In fact, the pick-up of enamel is affected by the strength of the neutraliser solution used, so the need for rigidly standardised conditions will be realised. It was therefore necessary to assume that there is a definite relation between the pick-up of the glass plate and that of the pickled and neutralised steel plate. (In the light of subsequent experience, the high degree of reproducibility of the test has justified this assumption.) The first attempts at calibration were derived directly from this assumption. The consistency of a small tank of enamel was adjusted to the required pick-up by a steel plate. A glass plate was then dipped, dried, and treated with oil so that it matched a glass plate freshly dipped in the same tank of enamel. The oil-treated plate was then bound between clear glass plates and preserved as a standard. Any sample of this enamel could then be adjusted until a glass plate dipped in it matched the standard, and the pick-up figure for steel was at once known to be the same as that of the sample used for preparing the standard.

By preparing a series of standards in this way, any sample of this particular enamel could have its steel pick-up value instantly determined by dipping a glass plate and comparing it with the standards until one of them was matched. The range it was possible to cover was bounded by the thickness, where extremely powerful lighting was required to make the plate appear at all translucent, and the thinness beyond which uniform draining was not possible. This range was, however, much greater than anything encountered in practice.

Naturally, any given set of standards will apply only to one frit (or combination of frits) milled to the same degree of fineness with the same mill-additions, but as a separate set of standards can be used for each frit and the remaining variables are usually standardised, this is not a great difficulty. Unless a number of tests are to be made on the same enamel, the preparation of standards would, however, not be worth while.

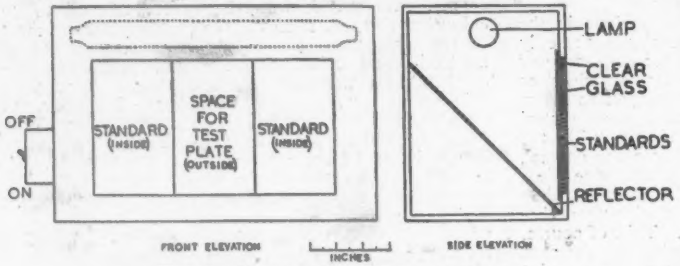


FIG. 1.—LABORATORY TEST APPARATUS.

Comparison Apparatus

In the first stages of development of the test, dipped plates were examined, and later compared with standards, by holding up to the light coming from a window, this being a simple method of obtaining uniform illumination. With some enamels it was found that the light thus available was not bright enough for close distinctions to be made, so it was necessary to turn to artificial illumination. The first type of apparatus used is shown diagrammatically in Fig. 1. Light from a tubular lamp (or if necessary a group of tubular lamps) is reflected by a white reflector on to the back of the standards and dipped plate, which are then observed from the front for the purpose of comparison. Originally three standards were arranged with spaces between them to take the dipped glass plate, but this was afterwards reduced to two standards, with a single space between. The consistency of the enamel was then adjusted until a dipped glass plate appeared intermediate in appearance between two selected standards.

This method proved satisfactory in laboratory use, although it was sometimes necessary to use it in a darkened room, when close comparisons were being made. The matter might have rested there had not interest been expressed in the test from a works point of view. Accordingly, experiments were started with the object of adapting it to works use.

First Works Trials

After preliminary discussions, which were not hopeful on account of the high sensitivity demanded, a sample of the enamel in use in the works was obtained and a series of standards prepared. The calibration figures were grams of dry enamel on a plate two square feet in area as used in this works, and subsequent references to figures such as 84 grams pick-up refer to a plate of this size. The preparation of a number of standards, differing but slightly one from another, proved very troublesome by the method originally used, and led to the use of oil-carbon tetrachloride mixtures for application of the oil. This method proved to be more readily controllable than oil spraying.

Differences in colour between the standards and the freshly dipped glass plate made accurate and close comparison impossible and led to the use of pink

colouring in the dry standard enamel to match the colour of the wet enamel. The need for strong uniform illumination was emphasised, and the advisability of obtaining this without too much heat became evident, as rapid drying-out of the enamel on the testing plate gave a false result.

With the small 5-in. by 3-in. glass plates previously used in the laboratory, it was found difficult to get duplicate glass plates of exactly the same appearance after dipping. Larger plates gave more consistent results, but a size of 12 in. by 12 in. did not drain uniformly, having streaks down the centre and a considerably greater density at the top than at the bottom. Plates 6 in. by 6 in. gave satisfactory results; they are free from streaks, have little difference between the appearance of top and bottom, and handle conveniently. Later, 6 in. by 4 in. was also found to be a suitable size. The use of ground glass plates, and the practice of rubbing the enamel on the plate during immersion, were found to effect no noticeable improvement in uniformity of coating.

It was also found that the standard glass plates, calibrated in the laboratory, did not correspond very well in pick-up weight with the figures given by the steel plate test as used in the works. This may have been due to the difference in size. For subsequent trials it was therefore decided to prepare, in the laboratory, a series of standards of increasing density, but to calibrate them under works conditions, directly from the test, using a plate two square feet in area. It was found unnecessary to alter the enamel consistency each time a fresh standard was prepared. By dipping a number of glass plates in enamel slip of average consistency, drying, and varying the oiling treatment, a whole series of standards can be readily produced, differing one from another by any desired amount. The oiling treatment can be varied by altering the concentration of oil in the oil-carbon tetrachloride mixture (a range of 5 to 25 per cent. was found to be the best to use) and by varying the number of times the dried plate is dipped in the mixture. With practice, almost any desired effect can be produced at will.

Sensitivity Requirements

As originally used in the laboratory; the sensitivity of the test was not high, although sufficient for the purpose for which it was designed. With application to works practice, sensitivity became of special importance. Unless the new test could compete in this property with the usual form of plate test, the saving of time would not alone secure its adoption. At first the differences it was necessary to detect seemed to be less than the differences produced by variations in the large number of factors involved in the new method. But as these variations were overcome, it became possible to see differences in pick-up of 4 to 5 grams from the 82 which represented the standard works figure. With uniform coating of standards and glass test plate, matching of the colour, and uniformity of illumination, it seemed that this figure could be considerably improved on. For practical use it was necessary to be able to detect differences of 2 grams. One great improvement was the use of more powerful illumination, and this is described in the development of a form of apparatus specially for works use.

Apparatus for Works Use

The apparatus first designed for works use (Fig. 2B) was intended to be used for experimental work as well as for routine testing; it may therefore seem at first sight to be rather complicated for a test so simple in principle. For everyday routine use a simpler and more compact type of apparatus has been designed.

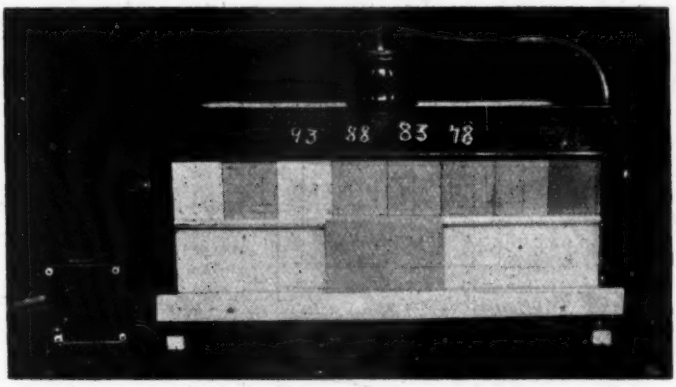


FIG. 2A.—GENERAL VIEW OF WORKS TEST APPARATUS SHOWN DIAGRAMMATICALLY IN FIG. 2B.

A wooden box has an opening 24 in. long by 8 in. high in the lid, which is vertical and hinged at the bottom edge. In the upper half of this opening is fixed a row of eight standard coated glass plates, each 4 in. by 3 in., sandwiched between a sheet of clear glass in front and a sheet of double flashed opal glass behind. Between these two sheets of glass a strip of clear glass at the bottom serves to keep the standards in the upper half of the opening without clamping them tightly. At a distance of half-an-inch behind the opal glass is fixed a sheet of Chance's "Calorex" glass, which prevents the passage of radiant heat from the lamp to the front of the apparatus, thus keeping this cool and avoiding evaporation of water from the wet enamel on the glass

Enamel Slip Consistency Test

test plate being matched to the standards. Since this "Calorex" glass absorbs radiant heat it gets very hot, and holes are drilled in the top and bottom of the box to allow free circulation of air to keep the "Calorex" glass cool and prevent it from cracking. Even so, it cannot be exposed to the full light of the lamp, which is shielded by a piece of heat-resisting glass, one surface of which is ground to assist in diffusing the light.

The lamp used is a tubular high pressure mercury vapour lamp, rated at 400 watts. In series with it are connected the necessary choke and a resistance, with a shorting switch to give dim or bright illumination as required. This type of lamp takes several minutes to develop its full luminosity, and if switched off when hot will not light up again until cool. It is therefore left running in the dim position between tests, being switched to bright when the actual comparison

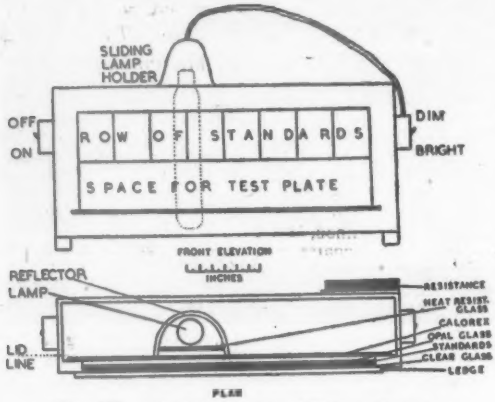


FIG. 2B.—APPARATUS FOR WORKS TESTS.

is being made. For some enamels, and thinner coatings, the dim position gives sufficient light for comparison, provided the external lighting is not too bright.

The lamp is fixed in a hemispherical reflector, made of asbestos sheet bent to shape and strengthened by a metal frame. The reflector fits against the "Calorex" glass and is of such a size that only a space 6 in. wide at the front of the apparatus is illuminated. This just covers the area of two standard plates and the test plate. The lamp and reflector slide in a slot in the top of the box, so that any two standards and the space below them can be illuminated, leaving the rest of the front opening dark. In practice there is some spread of light around the illuminated area, but this could be overcome by design modifications.

A ledge at the bottom of the front opening supports the bottom edge of the test plate, while a knife edge along the middle supports the top away from the front glass, thus helping to keep the latter clean and free from enamel.

Use of the Works Apparatus

Before the test can be put into regular use, the standards must be calibrated, i.e., given values in grams pick-up weight. This is done by means of small tanks of enamel slip of different consistency values as determined by the usual steel plate method under the normal works conditions. The glass test plate is dipped in these various tanks and matched to the various standards, which are then given

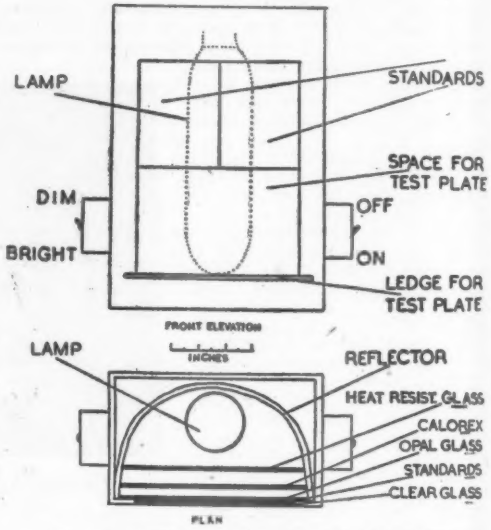


FIG. 3.—SIMPLIFIED WORKS TEST APPARATUS.

the corresponding pick-up values obtained by the steel plate test.

Having once calibrated the standards, the steel pick-up value of any sample of the same enamel can be instantly determined in a few seconds by dipping a glass plate and finding the standard which it matches.

Simpler Apparatus for Routine Use

For regular use, a whole series of standards would not be required; maximum and minimum values would be sufficient in most cases. A simple type of apparatus, shown in Fig. 3, can therefore accommodate two standard plates, which can be changed to suit the requirements at the time. The working enamel slip has to be kept between the limits represented by the two standards. For a change to a different type of article,

(*Concluded on page* 228).

METALLURGICAL FACTORS OF IMPORTANCE TO THE PRACTICAL ALUMINIUM FOUNDER

Report of Practical Experience with Aluminium Alloys

(Continued from page 210)

By S. A. E. WELLS

DISCUSSION IN MANCHESTER

Practice and Theory

MR. A. PHILLIPS inferred from the Paper that in melting aluminium alloys it was necessary, first of all, to take care of the gases and to avoid absorption of iron from the container, and then, when that had been done, when the metal was cast in the mould, it must not re-absorb gases from the mould. The problem of the removal of gases, especially hydrogen, from aluminium alloys was likely to be troublesome to founders for a long time to come.

In the early part of his Paper, Mr. Wells was very emphatic in stating that aluminium alloys should not be heated beyond a certain temperature. He differed somewhat from Mr. Wells' opinion in that respect, because nowadays it was not advisable to be dogmatic. At one period it was found that aluminium alloys of the silicon-aluminium type, when an addition of fluorides, etc., was made to the melt, underwent a change in physical condition. Along with others, the foundry with which he was associated had carried out experiments, and had discovered that, by adding the salts, and raising the temperature of the metal to 1,060 deg. C., then allowing the metal to cool down in the furnace, there was obtained an alloy which was of quite small grain size and free from gas. They had found that in many cases, where they had been told not to do a thing, that if they did it, the result proved to be satisfactory.

In some cases it was necessary to run very fine castings of aluminium, and to limit the temperature as Mr. Wells had suggested, but it was difficult to pour. What was Mr. Wells' opinion concerning the gating of alloys, because it was his theory that it was better to pour a mould at as low a temperature as possible. In such a case there would have to be very large runners, as well as an extended use of runners with sand castings.

One difficulty in regard to the absorption of iron in aluminium was the steeping in of the metallic elements when using a plunging-in method, as there would be a washing away of the plunger. What steel did Mr. Wells use for his plungers, because this was a difficult problem to solve in many cases? He, the speaker, had tried molybdenum steel, cobalt steel, and various other steels, but there still remained the washing away of the plunger and the skimmers used for aluminium alloys.

Repeated Meltings

There was also the question of the repeated melting of Alpax Gamma with and without flux additions. In the repeated melting there was an addition of flux and the time factor and the liberation of the gas in one instance, but there was no flux in the other instances, and the result was that there was gas absorption. Was there a particular gas absorption with the number of remelts? Aluminium alloys were used for die casting. In some of the slides exhibited there was a greater shrinkage in an alloy which had been degassified than in one which had a large gas content. It had been found that in making die castings from aluminium alloys it was preferable to have a little gas present, because there was less shrinkage at the same time as quick solidification. There was no pinholing, there was not such a large grain size, and there was a sound casting.

MR. WELLS remarked that Mr. Phillips mentioned the flux treatment of silicon-aluminium at particularly high temperatures, stating a temperature of 1,060 deg. C., which was consistent with the soda-ash modification process. He thought Mr. Phillips was confusing the refinement of the microstructure with the macrostructure, which is quite a different thing. He agreed that in this case there was refinement of the microstructure at high temperature, but if the macrostructure was examined, it would be found that there was a particularly coarse grain for the reason that it was treated at a very high temperature.

With regard to the material for such tools as plungers, skimmers, etc., Swedish heat-resisting iron was one of the best materials to use, but it was not obtainable at the present time. The next best thing was to use a cast-iron plunger with the original cast skin intact and coated with a protective wash; it seemed to give the best service. The next point was in respect to Alpax Gamma and the possibility of gas absorption on repeated remelting. His experience was that any gas pick-up was entirely dependent upon the conditions under which the remelting was carried out.

Dealing with gas in relation to die casting, he had mentioned the exercise of discretion when applying de-gassing treatment. The rapid rate of cooling helped because a greater amount of gas could be present without pinholes appearing. He had also mentioned that, with the gas removed, the feeding problems became greater. When dealing with die castings, it was better to carry as much gas as was practicable in order to offset some of the shrinkage difficulties which might occur.

Copper-Free Alloys

DR. FLEMING (Manchester) said that the first point he wished to raise concerned the list of materials given

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by Mr. Wells when he was discussing the grain refining effect of niobium. The remark was made that the aluminium-zinc alloy was copper free. Was there any great significance in the fact that it was copper free? His second point was whether the gassing of metal was caused by metal which had already been gassed. This was a point which had already been brought out several times. As he understood it, the gas solubility curve showed there was a sudden decrease in the solubility in freezing. Therefore, the maximum of gases the metal carried under normal cooling, once it was frozen, should be in equilibrium the second time the metal was allowed to solidify.

Was it possible actually to gas metal by using metal which had previously been gassed? Did it still increase the danger of gassing the second time? What was the reason for using a steel-sheathed pyrometer? While he could fully appreciate the usefulness, from the foundry point of view, of metal partially gassed for even normal castings to a certain degree in order to obviate shrinkage difficulties, was there any data on the effect on mechanical properties in allowing the retention of gas? Surely the effect must be a submicroscopical porosity.

MR. WELLS replied that the fact he mentioned aluminium-zinc alloys which were copper-free was merely incidental. It happened to be the case that he had checked them, and they were mentioned for no other reason. It was not intended to emphasise the copper-free nature of the material. With regard to the question of gas absorption by the addition of gassy metal to a melt, he thought it was correct to say there would be gassed metal from a crucible of metal which was substantially gas-free at the start. There was, in fact, damage done to the metal in the crucible by making the addition.

The point with regard to a steel sheathed pyrometer was that it would be found that readings would be upset through the attack of the flux in the case of the chromel-alumel type of thermocouple. A very considerable flutter was caused and a constant reading could not be obtained. Therefore, it was uncertain what the reliability was. The alternative was to use a steel sheath protected by a suitable wash. In further reply to Dr. Fleming, Mr. Wells said he was referring in all cases to a couple which had a welded junction.

DR. FLEMING said he had encountered a similar difficulty owing to the interference of slag on the reading. He wondered if that was the reason.

MR. WELLS, continuing, said the answer to Dr. Fleming's earlier question was that, as long as there was no visible porosity, the effect on mechanical properties was nil, because the gas was retained in solution. As long as there was freedom from porosity, the gas had no effect on the properties.

DR. FLEMING said he had somewhat of a doubt with regard to the de-gasser. His own opinion was that it was due to the smallness of the hydrogen atom which it was quite possible to hold within the lattice of the heavier metal atoms. He was rather intrigued with the idea of the larger bubbles sweeping up the hydrogen bubbles when the hydrogen bubbles were actually trapped within the lattice of the metal material. He wondered, with Mr. Phillips, whether the effect of the salts was merely to de-gas.

MR. WELLS would not like to say that the mechanism of these things was completely understood; but it had been demonstrated, both by himself and by other people, that to all intents and purposes the gas was removed.

MR. PHILLIPS inquired how niobium compared with titanium for price.

MR. WELLS said he had not studied the price angle, but he did not think there was very much in it. There was rather less of niobium required. Most of the alloys he had used contained substantial amounts of iron, and allowed the use of ferro-niobium for making the hardener.

MR. S. STANWORTH (Burnley) asked if Mr. Wells could give any information as to what would happen when the water vapour decomposed. Very small pieces of oxide must be formed in the metal. As a general rule, the fluidity of aluminium alloys was reduced each time they were remelted. It was to be imagined that this effect was due to the formation of oxides. The specific gravity of the oxide increased as the temperature increased, so that if the temperature of the aluminium was raised above 750 deg. C., the oxide tended to be heavier and to settle down to the bottom. When working at high temperature, it was to be imagined that it would be very much more difficult to get rid of the oxides. Was there any efficient means of doing so, once they had got into the aluminium in such a microscopic form as in the case of water vapour? It was to be imagined it was a case of suspension similar to a colloidal solution.

MR. WELLS said that the dissolution of the water vapour was more or less at the surface, and therefore did not necessarily lead to oxide troubles.

MR. PHILLIPS: Do you not get atomic hydrogen in that instance?

MR. WELLS: Yes.

Heavy Magnesium Losses

MR. E. LONGDEN (Manchester) said that, in regard to the manufacturing of some magnesium alloys carried out in U.S.A., the conclusion was arrived at that it was something like 25 per cent. or 27 per cent. loss of the alloy. He wondered what was the loss. Mr. Wells had referred to different heatings, and it would be interesting to learn how much metal was left. The hydrogen would not account for the loss of metal.

MR. WELLS said that the flux itself was removing the magnesium. In one series of remeltings, where the flux was absent, no changes occurred in composition; in the other only slight losses were recorded.

MR. LONGDEN asked if Mr. Wells considered oxidation was taking place.

MR. WELLS replied that there was oxidation in the absence of flux, but it was not very selective, otherwise serious losses of magnesium would occur on remelting if there was selective oxidation of the magnesium.

MR. PHILLIPS thought there might be a somewhat analogous effect to the addition of sodium carbonate on iron in order to remove sulphur. There was a similar method of adding sodium fluoride and carbon to a melt and then getting an affinity with magnesium. He was merely theorising.

MR. WELLS said that it was the flux which was doing the damage and removing the magnesium. This was indicated by the fact that straightforward melting did not cause losses, at any rate, to the same extent.

Aluminium Losses

MR. J. R. DAY (Denton) inquired whether it was not necessary to exercise considerable care when pouring the finished alloy from the melting vessel; for instance, a large amount of oxygen was taken up during the transference of aluminium through the atmosphere to the receiving vessel. There must be a loss of usable metal. What was the extent of it? It was well known that the greater the drop taken by aluminium the greater the loss there would be through oxidation. What was the safest distance to allow the metal to fall so that the greatest amount of loss in the aluminium could be eliminated?

MR. WELLS said that the drop through the air must be reduced to the lowest possible extent consistent with being able to carry out the work. He could not state any figures obtained through actual practice.

MR. DAY said it would be rather hard on a man who was dealing with 200 lbs. of aluminium to find he had only 195 lbs. left when the job was finished.

MR. WELLS agreed; but it would be stressing the point very much indeed to assume such a loss as that. It could not be very much more than something of the order of 1½ per cent. to cover both actual melting losses and oxidation of the kind mentioned.

MR. DAY said it had been mentioned in the course of the discussion by one speaker that he advised raising the temperature of the alloy to a very high degree and de-gassing in that way. Was there not a tendency to lose magnesium by so increasing the temperature, or would it always be stabilised?

MR. WELLS said that the alloy referred to did not contain magnesium.

MR. LUDLOW remarked that Mr. Wells had dealt with what might be termed high-strength alloys. In wartime certain alloys were thrust upon the industry which were not as good in some respects. He was thinking particularly of D.T.D.424. Had Mr. Wells any information to offer concerning that alloy—as to what precautions must be taken in casting up and any other allied problem?

MR. WELLS replied that the ordinary normal precautions associated with the handling of high-grade materials will ensure the best results with D.T.D.424. He could not offer any special information.

MR. A. PHILLIPS said that D.T.D.424 was a poor alloy with which to work; to get the tests of 9.0 tons ultimate and 2 per cent. elongation was very difficult. The addition of titanium to D.T.D.424 was one of the best ways he had found.

Burning of Aluminium

MR. E. CLEGG (Burnley) said there seemed to be quite a theory among foundrymen that aluminium could be burnt; in other words, it could be raised to such a high temperature that the metal could be ruined. Was this possible? Further, he would welcome an expression of opinion concerning the reverberatory melting of aluminium alloys. Was this a really practicable form of melting? A number of furnaces were on the market for this particular type of work. When alloys were used for die-castings they were generally very high in zinc content. Was the elongation always low, and was it practicable to make it any better? A further point upon which he would like information was whether the removal of zinc from an aluminium alloy was practicable. Was there any method whereby the zinc content could be lowered?

MR. WELLS said that, with regard to the burning of aluminium, he did not know what temperatures Mr. Clegg had in mind, but he had more or less shown what might happen as a consequence of using high temperatures. There was the question of grain coarsening and the absorption of gases if conditions were favourable in that respect, but he did not quite understand what was meant by the term burning. As far as deterioration was concerned, it was a question of excessive oxidation; there was possibly excessive gas taken up, and grain coarsening in the absence of a refiner, or it was possible, by going high enough, that the refiner would not be effective. He had gone to about 900 deg. C., but there was no necessity for that temperature in the ordinary way.

MR. CLEGG said that with reverberatory melting there was sometimes a flash-off. There was excessive oxide in a reverberatory furnace, and it automatically generated heat. When such conditions occurred, there might be metal in the furnace which actually came out in the aluminium. Was that metal still useful? By the addition of titanium, or anything else, could it be brought back to the condition of workable material?

MR. WELLS had not had any experience of dealing with the melting of aluminium alloys in reverberatory furnaces, though he knew the method was employed very often. He could not appreciate the condition the metal was in.

MR. PHILLIPS said that if it was left in the furnace until the metal was in the neighbourhood of the correct pouring temperature, the metal would be satisfactory when melted in a reverberatory furnace.

Zinc Content

MR. WELLS disagreed with the statement that most of the aluminium alloys used for die-castings contained high zinc. Generally speaking, people liked to keep their zinc contents low for die-castings, because of the hot shortness tendency. He regretted he was not in a position to offer any advice concerning the removal of zinc.

MR. FIELDING (Manchester) said that the theory of hydrogen absorption was a very old one. He could quite well understand it to be the case in connection with the ingots, when they were not altogether free from moisture or oxide. What he was puzzled about was the absorption from the wet coke or from the foundry atmosphere. He would like to have a little more light thrown upon this old theory.

Aluminium Founding

MR. WELLS said it was a fact that, when water vapour was present, the trouble did occur. The gas absorbed as a result had been analysed and had been found to be hydrogen. There did not seem to be any doubt about it.

MR. FIELDING asked whether it was proved that the hydrogen had been taken from the atmosphere or whether it was present in the original ingot.

MR. WELLS said it had been proved that hydrogen was absorbed from the atmosphere when the conditions were such that water vapour was present.

MR. FLEMING thought it was correct to state that in cases of metal equilibrium the presence of a gas such as CO_2 had very little effect upon the equilibrium between the hydrogen and the metal. The balance was purely a question between the metal and the hydrogen and the further gas had no effect upon the equilibrium.

MR. WELLS agreed.

MR. A. PHILLIPS said that in an exchange Paper from a German writer it was definitely proved that there was absorption of hydrogen in the aluminium alloys. This Paper was received by the 1938 Conference.

Grain Size and Strength

MR. E. R. WADDINGTON (Southport) inquired whether there was any relation between grain growth and heat-resisting qualities. In the case of a job like a light piston for an aero engine, would it be advisable to maintain a large grain or a small grain?

MR. WELLS thought that a coarse grain should never be countenanced in any casting of that sort. A piston was working at elevated temperature, and coarse-grained material was definitely very much weaker than that which was of fine grain. For mechanical strength reasons coarse-grained material should not be used for such things as pistons.

MR. MARSDEN asked, with respect to die-casting and titanium, what quantity of titanium should be added.

MR. WELLS said there was no necessity to keep on adding titanium; it was not lost. All that was necessary was to look after the stirring, so that the material at the bottom of the crucible was not enriched at the expense of the top by segregation. There was no point in making an addition; it was unnecessary.

MR. DAY thought the speaker had the ingot form in mind.

MR. MARSDEN said he should have mentioned D.T.D.424.

MR. WELLS said that the amount of titanium added should be of the order of 0.15 per cent. Once it had been added, there should be no further addition; it was not lost. The only tendency was segregation, which was overcome by frequent stirring during the process.

MR. DAY asked whether there was any possibility of absorption of hydrogen from the mould by the metal in the case of green-sand or dry-sand moulds.

(*Concluded in next column.*)

A NEW TEST FOR MEASURING ENAMEL SLIP CONSISTENCY

(*Concluded from page 224*).

such as plates to tubes, or small to large hollow-ware, the standards are exchanged for others which have been previously proved in practice to be suitable.

Although the test has been designed primarily for use with vitreous enamels, its use for pottery glazes, or even to paints, has been suggested, but these proposals must be left to others to work out.

Attempts are at present being made to enable the test to be used without the preparation of fresh standards for every change in mill additions or type of frit. A difficulty encountered in works tests was the surprising change of colour of the enamel slip produced by the use of a different type of clay. Differences might also be expected from different degrees of smelting of the enamel frit. To overcome this colour difficulty it is proposed to use standards neutral in colour and introduce colour filters in the top half of the illumination, so as to match the colour of the standards to that of the wet enamel on the glass test plate. Another possibility that is being examined is the use of a photo-electric cell in place of the human eye for the purpose of light transmission measurements.

Acknowledgement

During the course of this work much valuable advice and assistance have been received from several members of the Institute, in particular Mr. W. Todd, Mr. S. Hallsworth and Mr. S. W. Vickery. Thanks are also due to the Parkinson Stove Company, Limited, for facilities given for carrying out tests under works conditions.

Recent D.T.D. Specifications.—Recent D.T.D. Specifications include the following:—No. 131B: Aluminium alloy sand or die castings (heat-treated) (suitable for pistons, etc.) (superseding D.T.D. 131A), July, 1943. No. 298: Aluminium alloy sand or die castings (not suitable for pistons), May, 1936 (reprinted August, 1943, including Amendment Lists 1 and 2). No. 323: Aluminium-nickel-silicon brass tubes (medium pressure), December, 1936 (reprinted August, 1943, including Amendment Lists 1 and 2). No. 356: Wrought light aluminium alloy sheets and strips, Amendment List 2, August, 1943; and No. 390: Aluminium-coated aluminium alloy sheets and coils, Amendment List 1.

(*Concluded from next column.*)

MR. WELLS said there was in some materials: they were usually those containing rather high magnesium contents—the D.T.D.300 type. He did not think there was any particular trouble in the case of other types of alloys.

MR. WELLS was accorded a very cordial vote of thanks, on a proposition made by Mr. A. L. Key, seconded by Mr. Greenwood.

A WELL-ORGANISED WORKS VISIT

DISCUSSION ADDS VALUE

The new session of West Riding of Yorkshire Branch of the Institute of British Foundrymen was opened on September 18 by a visit to the foundry of the English Electric Company, Limited, at Bradford. The visitors, numbering about 100, under the presidency of Mr. L. Turner, of Elland, were received by Mr. F. Griffiths, manager of the foundry and members of his staff, including Mr. D. Scanlan, who later gave a Paper dealing with the scientific organisation of the working system at the Dick Lane establishment.

MR. L. J. SARJEANT, General Manager, who gave the visitors a cordial welcome, said although he was not a foundryman, he recognised the vital importance the foundry played in the engineering industry, and he was not sure whether, if he were starting his career again, he would not desire to go into the foundry—there seemed to be something particularly satisfying about it. There was so much scope in it for diverse opinion and so much still to be learned about its further potentialities. In spite of its being an old industry there were so many factors, big or little, which—thanks to the changes and developments of time—it was still possible to separate out for further investigation and precise control.

Processes Described

MR. GRIFFITHS, detailing what was to be seen in the course of the tour of the patternshop, the foundry and the enamelling shop, laid emphasis on the fact that a large proportion of the work at this foundry was done on moulding machines, especially the Ronceray type. In the main wooden patterns are used to the extent of 99 per cent. There were two good reasons for this: (1) The patternmaker is the man to make patterns, and he makes them better than anyone else, and (2) owing to the enormous number of patterns in use, this method enables the storage of much larger quantities in the space available than could otherwise be the case.

MR. GRIFFITHS, after referring to the labelling and classification system which enabled any pattern to be found quickly without the slightest difficulty, reminded the meeting of a talk he had given some time ago to the Institute branch on jigs as made and used at Dick Lane foundry, and proceeded to demonstrate how these were prepared and operated. The machine moulders worked in pairs, one to make the cope part and the other the drag. Jigs are provided in various sizes, and patterns are made according to these sizes. The jigs were later seen by the visitors on the machines, where it was observed how the patterns were fitted into them. The system enabled the foundry to make large numbers of moulds from patterns without any damage to the patterns—all the shock of jarring being absorbed by the jig, which meant that there could be no damage to the pattern unless some accident occurred.

Sand Handling

Until recently moulding sand was mixed in the centre of the foundry and stored for use. One of the bad features of that method was that the sand tended to include metal spillage. Now they had installed a plant where all the sand was tapped from receptacles on a grid at the foot of an elevator for conveyance to a rotary riddle, and from there into a rotary type hopper, which deposited it into a batch loader and thus into the mill. The necessary water was added, and careful control as to the amount of water required was exercised so as to ensure a moisture content of about 4½ per cent. They were still preparing facing sand, but it was hoped before long to dispense with it and use nothing but their system sand. The basis of their sand for 18 years past had been Belgian sand, but under war conditions they had had to turn to the use of synthetic sand, and Mr. Griffiths provided the visitors with the details of the mixings used.

Dealing with the manner of getting metal from the cupola. MR. GRIFFITHS drew attention to the use of the syphon brick. Though it was Saturday afternoon, arrangements had been made in the foundry for 2 tons of metal to be melted to show the tapping process and the carrying away in shanks. They had, said Mr. Griffiths, a corebox from which they made the syphon brick. It was made by a coremaker, and ultimately they had an article with two tapping holes 7 in. apart. On the inside was to be seen a hole like that in the cupola, following normal methods. This brick is inserted in the cupola, and when it is in position the ordinary process is followed in preparing the cupola. The floor of the cupola is levelled or slightly inclined to the hole of the syphon brick. The metal eventually ascends the channel of the brick, and will continue to flow from the upper hole while there is a 7 in. depth in the cupola. The metal flows or stops as the blast is on or off, as easily as working a water tap. The "syphon" brick was personally thought to be indispensible to the continuous method of casting used. It should be noted that casting is started at 8.30 a.m. and continues until 6.15 p.m., and nearly all the moulds are poured from hand shanks, because the castings are light, the average weight being 11 lbs. Eight men working in pairs pour almost all the moulds catching the metal at the cupola spout, and they carry the metal away in double-handed shanks, taking an average of 70 lbs. each journey. In the course of the day they carry from 500 to 550 shanks, an arrangements which allows the moulders to make moulds the whole of their working time. Since adapting this method the number of moulds has been increased by 25 per cent. by the same number of moulders. Th average life of the "syphon" brick is three months.

Foundry Space Requirements

Before proceeding on a tour of the works hearty thanks were expressed to Mr. Sarjeant for his welcome and to Mr. Griffiths for his introductory talk on the work to be seen, by the Branch-President (Mr. L. Turner), who took the opportunity to include thanks also to those who acted as guides on the tour.

In the course of questions after the works tour—and voicing thanks for hospitality accorded at tea—MR. J. BLAKISTON said he had been greatly impressed by the

Well-Organised Works Visit

excellent working system. As one who had seen quite a number of foundries, he always had a feeling that large electrical foundries for light castings appeared somewhat too big for the job in hand and that however well they were operating, they might do even better if they had somewhat fewer acres of floor space. This opinion he had no doubt was one with which not all in the industry would agree, and he thought it would be a very useful thing if one day the members could discuss the subject with a view to reaching some consensus of opinion as to what exactly would be the ideal dimensions for a light castings foundry.

Both MR. DAVISON and MR. GRIFFITHS acknowledged the thanks expressed.

Scrap Reclamation

In answer to a question as to whether any estimate was made of possible scrap value in "doubtful wasters" or occasional repair by welding, MR. GRIFFITHS said they did comparatively little reclamation. As a general rule, when they had scrap, it was definitely regarded as scrap.

MR. BLAKISTON said he appreciated Mr. Griffiths' point, but there was an indication at present to the effect that there had been so much advance in welding that a large proportion—some said almost 100 per cent.—of scrap might be recoverable.

MR. H. FORREST said many waster castings could be caused by bad pouring, and by ensuring pouring was properly carried out the reduction of defective castings was inevitable.

MR. D. SCANLAN said it was established that the men at this foundry poured the castings correctly and they were given a set time to do it—actually 7 min. As was seen, the shank men work in pairs and if the foundry manager considers a pair of men are responsible for a bad casting, the pair concerned are reprimanded.

Referring to the syphon brick, a visitor asked, was the blast gate on the cupola adjusted according to degrees of speed of melting and quality and size of scrap?

MR. GRIFFITHS said there was no reduction gear to control the speed of the fan; it was either open or closed, but there was under consideration at present the idea of adopting a reduction gear. He would welcome any information from anybody who has had experience of reduction gear on fans.

In answer to a questioner, who inquired what was the average percentage of blow whilst the blast was on—did they manage to blow for, say, 90 per cent. of the whole time they were casting?—MR. GRIFFITHS replied that, generally speaking, they would be blowing about 60 per cent. of the time. If they had moulds ready by leaving overnight, they might probably do more blowing time, but they did not leave overnight because there was always the risk of damage by the night gang whilst knocking out the boxes.

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NEW CATALOGUES

Molybdenum in Steel.—Climax Molybdenum Company of Europe, Limited, 2 and 3, Crosby Square, London, E.C.3, have now available in loose-leaf form, for inclusion in the main catalogue which they issue, a new Section II and an odd sheet to go in Section V. There are 32 new pages covering the subject of Cr-Mo steel in all its aspects, including the important effect of high manganese; case-hardening steels; 0.30 per cent. carbon, 1 per cent. Cr, 0.20 per cent. Mo variety in both bar, sheet and tube form. The higher carbon materials are similarly dealt with and in all cases some notes on welding are included. The 3 per cent. Cr-Mo —an interesting steel—is covered as to its mechanical properties both in the heat-treated and carburised conditions. For steelmakers, this catalogue ranks amongst the most useful placed at their disposal by manufacturers of their raw materials.

Philbolts for Foundations.—When machine tools and the like have to be moved to a new location in the works, it is often quite a problem to affix the foundation bolts. Philplug Products, Limited, whose products are sold by the General Electric Company, Limited, of Magnet House, Kingsway, London, W.C.2, have devised a special bolt known as the "Philbolt." This consists of a standard hexagon-headed bolt on the shank of which is placed a lead spread and a steel wedge. In practice the assembled bolt is placed in the hole and the wedge is driven into the spreader by a short piece of piping placed over the threaded portion of the bolt. The spreader expands into the masonry and a firm anchorage is assured.

Electric Unit Heaters.—The General Electric Company, Limited, of Magnet House, Kingsway, London, W.C.2, announce the introduction of a new model to their range of heating units. It is of 2½ kw. rating, mounted on a bracket, by a trunnion which allows of adjusting the angle of warm air discharge through a range of 120 deg. in the horizontal plane and 45 deg. in the vertical. In summer, the fan can be operated so as to give a cooling effect. Of a really neat design and finished in a bronze stove enamel, the unit will find many applications for heating offices and small manufacturing bays.

(*Concluded from previous column*).

In reply to Mr. Forrest—who asked whether any special oil or other parting medium was used to prevent the rather sticky facing sand from clogging in the patterns—MR. GRIFFITHS said he had not experienced any real trouble with the patterns in that respect. Occasionally, but only rarely, they dealt with the matter by spraying a little paraffin on it.

MR. D. SCANLAN gave a highly informative talk describing the organisation of work and costings at the Dick Lane foundry, extracts from which will be given in a later issue of the JOURNAL.

NEWS IN BRIEF

THE PORCELAIN ENAMEL & MANUFACTURING COMPANY, Baltimore, has changed its title to Pemco Corporation. The company has entered a much broader field of operation.

DEPENDABLE JIGS & TOOLS, LIMITED, GEARS & CASTINGS, LIMITED, and TRUE GAUGES, LIMITED, are being wound up voluntarily. Mr. Harris Rainsbury, 23-26, Broad Street Avenue, London, E.C.2, is the liquidator in each case.

AT THE NEXT MEETING of the Sheffield Society of Engineers and Metallurgists, which will be held in the Royal Victoria Station Hotel, at 2.30 p.m., on Saturday, November 20, Mr. A. Poole will give a lecture, entitled "Small Bar Rolling Mill Plants."

WALSALL'S LATEST WORKS CANTEEN was formally opened on November 9 at the works of Matthew Harvey & Company, Limited, general ironfounders, when the firm entertained all the workpeople in celebration of its inauguration. There is accommodation for 250 in the canteen.

AN OVERHAUL of existing negotiating machinery in the engineering industry was demanded at a special conference of the Amalgamated Engineering Union in London. Comments on the slowness of the machinery, which was established 30 years ago, were made during a long discussion.

INDIVIDUALS OR ORGANISATIONS who possess European reference books—guides, maps, directories, catalogues and technical dictionaries—can help to foil enemy secrecy measures by giving or lending such books to the nation. The correct address to which to send these books is Room 629, Ministry of Economic Warfare, Lansdowne House, Berkeley Square, London, W.1.

MR. H. A. J. SILLEY, chairman and managing director of R. & H. Green & Silley Weir, Limited, the London ship repairers, and his brother, have given to the Guild of Benevolence of the Institute of Marine Engineers such sums under a covenant for seven years as will in process of time aggregate to approximately £20,000, in memory of their late father, Mr. John Silley, a former president of the Institute. Mr. Silley's company is giving the sum of £10,000. The two donations will form "The John Silley Memorial Fund."

EIRE FOUNDRY WORKERS' WAGES

An application for a supplementary cost-of-living bonus on behalf of 142 workers employed by the Hammond Lane Foundry, Dublin, was made by the Irish Engineering and Foundry Union at a sitting of the Wages Advisory Tribunal in Dublin. Mr. W. Aitken, on behalf of the Hammond Lane Foundry, said that they were not opposing the application, but thought it should have been made on a national basis. In the case of the Waterford Foundry, where the basic wages were lower, a 2s. bonus had been granted, leaving their competitors in a more favourable position.

PERSONAL

CAPT. G. F. DAVIES, R.A., has been appointed a director of Hick, Hargreaves & Company, Limited, Soho Iron Works, Bolton.

MR. WILLIAM GLASS, director and works manager of Johnson & Phillips, Limited, manufacturing electrical engineers, has been appointed deputy managing director. MR. STANLEY J. PASSMORE and LT.-COL. R. W. C. REEVES have been elected directors of the company.

MR. HENRY KIRK, a director of Thos. W. Ward, Limited, Sheffield, has retired from that position. He has had 53 years' service with the company. He will continue his association with the firm, but in a less arduous capacity. In 1890, after nine years with the Midland Railway Company, he began work with Mr. Thos. W. Ward, and was put in charge of the railway department in 1892. He was made a local director in 1912, and a full director in 1919. He travelled extensively on the company's behalf.

DR. CECIL H. DESCH was the principal guest at a private luncheon given in his honour at the Savoy Hotel in London last week, to mark the occasion of his recent appointment to the board of Richard Thomas & Company, Limited, to direct metallurgical research and development. Mr. Barrington Hooper, C.B.E., managing director of Industrial Newspapers, Limited, presided. Speakers, in wishing Dr. Desch every success in his new sphere of activity, paid high tribute to his many valuable contributions to metallurgical science.

Wills

WOODWARD, R. G., of Sheffield, a director of Edgar Allen & Company, Limited, steelmakers ...	£22,984
PARKER, Charles, of Broughty Ferry, Angus, retired engineer and ironfounder, for many years a director of Charles Parker, Sons & Company, Limited, Dundee	£22,076

GJERS, MILLS & COMPANY

Proprietorship of the Ayresome Ironworks, Middlesbrough, first established in 1871, has been disposed of by Gjers, Mills & Company, Limited, to the Whitehead Industrial Trust, Limited. The business, it is understood, will be continued under the old title, but the chairman of the company, Mr. Charles Mills, has retired and is succeeded by Mr. Leslie F. Wright, who is to fill the joint posts of chairman and managing director of the new company. He joined Gjers, Mills & Company in 1918 as research chemist and latterly has been assistant works manager and commercial director. Mr. T. W. Thursfield, at present with the South Durham Steel & Iron Company, Limited, has been appointed works manager, with a seat on the board.

The company, which specialises in the production of hematite and high-grade pig-irons, has an authorised and issued capital of £270,000 in £1 shares. It is understood that virtually the whole of the new capital has been placed privately.

NEW COMPANIES

("Limited" is understood. Figures indicate capital. Names are of directors unless otherwise stated. Information compiled by Jordan & Sons, 116, Chancery Lane, London, W.C.2.)

J. D. Crozier & Partners, 29, Woburn Place, London, W.C.1—Engineers. £10,000.

Rostron & Strong, Shenton Street, Hyde—Welding engineers. £1,000. J. Strong, F. Hampson and F. Swann.

Wolverhampton Rolling Mills—£10,000. W. H. Barnes, 12, Hamilton Road, Thornton Heath, Surrey, subscriber.

T.N.R. Engineering Company, 4 and 6, Heywood Road, Castleton, Rochdale—£2,000. F. Tweedale, S. Rigg and D. Nightingale.

A. H. Arnold, 162, Ballards Lane, Finchley, Middlesex—Engineers, etc. £1,000. A. H. and M. Arnold and C. E. Loveless.

F. G. Burgin & Company, 22, Whittall Street, Birmingham—Engineers, tool makers, etc. £10,000. F. G. Burgin and J. A. Bebbington.

George Cash & Company, 37, Aylward Street, Portsea, Portsmouth—Iron and steel founders. £4,000. D., L. D., and H. Morgan Gammans.

J. N. Morrison, 1 and 2, Marlborough Yard, London, N.19—Machinery and metal merchants. £100. J. N. Morrison and W. L. Coventry.

Birmingham Die-Casting Company, Shaftesbury Works, Ponders End, Middlesex—£100. J. W. Cartlidge, R. J. Tugwood and A. H. Goodwin.

T. Davies & Son (West Gorton), Railway Ironworks, West Gorton, Manchester, 12—Ironfounders, boiler makers, etc. £3.000. L., T., and S. Davies.

Mendenhall (Subsidiary), 21, Golden Square, London, W.1—Engineers, valve and tool makers, etc. £1,000. E. and J. A. Mendenhall and G. E. A. Fitch.

Radiarc Company, 45, Fenshaw Road, London, S.W.6—Tool makers, engineers, welders, etc. £1,000. V. Paddock, W., E. H., E. A., and E. Gregory.

Diffusion Alloys, Canberra House, 313-319, Regent Street, London, S.W.1—Manufacturers of and dealers in corrosion and acid-resisting alloys, etc., £1,000.

Fyfe & M'Grouther, 144, St. Vincent Street, Glasgow—£2.000. Metal merchants, shipbuilders' engineers, colliery and mill furnishers, etc. R. Mouat and D. G. A. Andison.

NEW TRADE MARKS

The following applications to register trade marks appear in the "Trade Marks Journal":—

"R R"—Aluminium alloys in the form of ingots, billets, castings, or forgings. ROLLS-ROYCE, LIMITED, Nightingale Road, Derby.

"FENIXMORE"—Shaped linings for furnaces, grates, and stoves; chimney flues for stoves and grates. PERCY GEORGE YOUNG, 60A, Hampton Road, Southport, Lancashire.

"TIPCO"—Unwrought and partly wrought metals; rolled and cast metal building materials; metal forgings in the rough; forged and fashioned common metals; wrought ironwork; worked wire, etc. C. R. TIPPING & COMPANY, LIMITED, Charlton Grove, Leeds.

COMPANY RESULTS

(Figures for previous year in brackets)

Guest, Keen & Nettlefolds—Interim ordinary dividend of 4% (same).

Metal Industries—Interim ordinary dividend of 2½% (same), less tax at 9s. 9d. in the £.

British Piston Ring Company—Final dividend of 20% on the ordinary shares, making 25% (20%).

Drake & Gorham—Net profit for the year to June 30 last, £11,018 (£12,382); dividend of 5%, £6,250 (same); forward, £17,662 (£12,894).

Atlas Steel Foundry & Engineering—Final dividend of 5s. 6d., including bonus, making total distribution of 8s. 6d. for year, equal to 42½% (32½% and bonus of 10%).

Yarrow & Company—Net profit for the year to June 30, £58,816; dividend and bonus of 10% and 5% respectively, both tax free (same); to reserve, £35,000; forward, £35,397.

Linley Engineering—Net profit for the year to March 31, £4,372 (£3,666); to general reserve, £2,750; dividend of 10% (7½%) and a bonus of 2½% (same), £2,812; forward, £2,824 (£4,724).

Martin Bros. (Machinery)—Net profit to June 30, £19,078 (£16,776); taxes, £10.363 (£9,633); depreciation, £890 (£916); tax reserve, £2,672 (nil); dividend of 12½% (same), £4,688; forward, £25.343 (£25.228).

R. & W. Hawthorn, Leslie—Profit for the year ending June 30, 1943, £133,632 (£130,934); dividend of 10% (same), £53,741; bonus of 5%, £26,871; to general reserve, £50,000; forward, £56,169 (£53,148).

Wombwell Foundry & Engineering—Profit for year, £15,205 (£13,166); final dividend of 10%, making 16% (12½%); to depreciation, nil (£2,000); taxation, £5,439 (£6,023); to general reserve, nil (£500); to taxation reserve, £4,300 (nil); forward, £5,254 (£5,438).

Ferranti—Profit for the year ended June 30, after provision for taxation, £142,981 (£132,355); depreciation, £51,859; war damage insurance, £4,006; reserve for deferred repairs, £12,000; preference dividends, £17,500; to contingency reserve account, £35,000; dividend of 6%, free of tax, on the ordinary stock, £18,000 (same); forward, £75,734 (£74,940).

Arthur Lee & Sons—Profit for the year ended July 31, after charging E.P.T., £268,343 (£267,610); interest and dividends, £10.234 (£8.475); to reserve for depreciation of stock, £883 (£26.011); depreciation and plant scrapped, £50.669 (£44.533); to reserve for deferred repairs, £19,001 (£13,714); War Damage Act insurance, £3.851 (£5,629); income-tax, £110,937 (£105,019); net profit, £92,306 (£81,179); accumulated surplus on realisation of investments, £15,000 (nil), to surplus investment reserve, £15.000 (nil); to new plant reserve, £35.000 (£50.000); dividend of 40% on the ordinary shares; forward, £48,621 (£50,427).

MR. G. P. REES, who for 47 years has been blast-furnace manager at the Lilleshall Company's works at Priors Lee, retired on November 6. He received presentations from the management and staff.

Save Fuel
in your CUPOLAS
by using
STANTON
SAND-LESS
Machine Cast
PIG IRON
THE STANTON IRONWORKS COMPANY
LIMITED NEAR NOTTINGHAM

ANGLO-AMERICAN STEEL SURVEY

PRODUCTION IN THE DOMINIONS

The Anglo-American Steel Mission, after a five-months' tour, has completed its special survey of steel production and use in several of the Dominions, in India, and in the Middle East. The results have been reported to the Steel Committee of the Combined Raw Materials Board and the Combined Productions and Resources Board. Mr. H. S. Batcheller, of the Combined Steel Committee, said it was hoped that, with the information obtained from the various Dominions and India, it would be possible for the combined boards to complete the Allied Nations' balance-sheet of steel production and requirements.

The mission consisted of Sir John Duncanson, British Iron and Steel Controller, and Mr. Earl A. Emerson, president of Armco International Corporation, of Middletown, Ohio. They were accompanied by Mr. Norman Anderson, of the British Iron and Steel Control, and Captain Alexander H. Gaal.

Four Recommendations

The report draws attention to the progress already made in the Empire countries surveyed in the control of steel. The mission made four recommendations to the combined committees:

1. That there should be established in the United Kingdom an organization to co-ordinate information on British and American steel controls and to circulate such information among the Dominions.

2. That the Dominions should be asked to advise this co-ordinating body of savings they have been able to make, and the method used, to be considered for adoption by the United States and the United Kingdom.

3. That a careful study should be made of any further surplus capacity arising in the Dominions so that one Dominion might supply more of the requirements of another. This would, of course, save shipping space for other essential purposes by easing the burden on the United States and the United Kingdom.

4. That when standardization of controls is completed all steps possible should be taken to facilitate action on requirements submitted to the United Kingdom and the United States by the various Dominions.

NEW PATENTS

The following list of Patent Specifications accepted has been taken from the "Official Journal (Patents)." Printed copies of the full Specifications are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1s. each.

556,409 QUALCAST, LIMITED, and JOBSON, J. E. V. Casting of metals.

556,422 BRADBURY, T. F., and MOORE, W. J. M. Aluminium alloy.

556,436 HATFIELD, W. H., and BRIDGE, J. F. Casting of metals.

556,474-5 MAGNESIUM METAL CORPORATION, LIMITED, and SPOONER, E. C. R. Manufacture of metallic magnesium.

AMERICAN STEEL PROFITS

Net earnings of American steel companies in the first half of 1943 dropped 8 per cent. below the corresponding period of last year, and were 40 per cent. less than earnings in a representative peacetime year like 1937, it is indicated in a report by the American Iron and Steel Institute. In the six months, net earnings of the companies, after all charges and before dividends, totalled $94,522,000. In the corresponding 1942 period, substantially the same group of companies earned a total of $102,743,000, and in 1937 the corresponding figure was $159,054,000. Indicated return on investment in the first half of this year was at the rate of 4.9 per cent. per year, as against 5.3 per cent. a year ago.

A sharp increase in total payrolls was the major factor in the decline in earnings. For the first six months of this year, aggregate payrolls of the reporting companies amounted to $1,236,485,000, nearly 30 per cent. more than the total payrolls distributed in the first half of 1942. The amount of taxes provided for by the companies in the first half of this year was $335,178,000, somewhat less than tax provisions in the corresponding period of 1942, when large amounts had to be set aside for taxes before the tax laws for the year were finally enacted.

Dividends paid to stockholders of the industry were lower in the first half of this year than in the same period of 1942, amounting to $69,372,000 this year, compared with $72,846,000 a year ago. Dividend payments this year were equivalent to 5.6 cents per dollar distributed in payrolls, compared with 7.5 cents per payroll dollar in the first six months of 1942. Dividends in the first half of this year are down about 5 per cent. from those paid in the first half of 1937.

OBITUARY

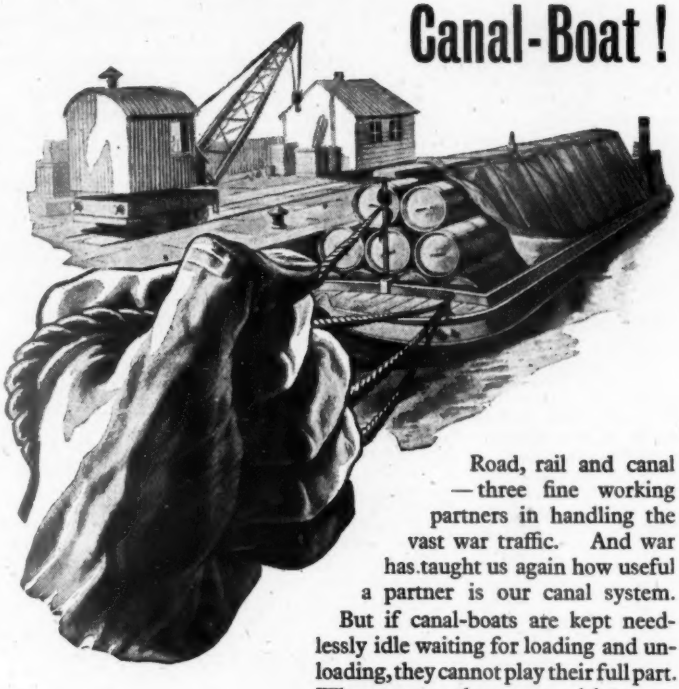
MR. EDWIN ASHTON, machinery merchant, of Horbury Bridge, died on November 5.

SIR LOUIS FREDERICK PEARSON, head of the Beeston Boiler Company, Limited, died in Nottingham on November 5, at the age of 80. During the last war he was president of the Nottingham Munitions Board. He was made C.B.E. in 1919 and knighted in 1923.

MR. JOHN WRIGHT, founder of Wright, Anderson & Company, Limited, structural engineers, Gateshead, has died at the age of 74. He founded the firm of Wright, Anderson & Company, Limited, 35 years ago, and he was managing director for most of the time.

MR. ERNEST WILLIAM BACHE died at West Bromwich on November 5, aged 66. In 1915, he became a director of George Salter & Company, Limited, manufacturers of springs and weighing machines, and three years later was appointed chairman and managing director. He served as chairman of the Management Committee of the Birmingham section of the British Industries Fair in 1929, and was president of Birmingham Chamber of Commerce in 1931. In 1930, he was president of the Birmingham Association of the Engineering and Allied Employers' Federation.

You're holding up more than a Canal-Boat!



Road, rail and canal — three fine working partners in handling the vast war traffic. And war has taught us again how useful a partner is our canal system. But if canal-boats are kept needlessly idle waiting for loading and unloading, they cannot play their full part. Whenever you keep a canal-boat one unnecessary hour you delay our whole transport system, holding up perhaps a fleet of lorries or a large train of wagons. *You* don't see the hold-up, but it happens just the same.

You know your own problems best. Tackle them in your own way. But tackle them now. Plan, encourage ideas, improvise if needs be. Here's a starting-off agenda.

1. CLEAR LABELS AND DOCUMENTS
2. LABOUR SAVING DEVICES.
3. WORK IN BLACK-OUT AND AT WEEK-ENDS.
4. OPINIONS OF "MEN WHO DO THE WORK"

QUICKER TURNROUND THAN EVER BEFORE

Issued by the Ministry of War Transport

4

Raw Material Markets

IRON AND STEEL

The lull in some departments of the foundry trade continues, though the iron and steel industry as a whole is still very busy and is turning out a large aggregate production. It is not yet clear whether the lessened activity at some of the foundries, particularly the jobbing establishments, is merely a temporary phase or is due to a decision on the part of the authorities to cut down permanently the production of some munitions of war. Certainly, there has been a curtailment of the demand for certain types of engineering castings. As a result, a number of foundries have surplus capacity. At the same time, it must be recorded that a large tonnage of castings is still wanted in connection with urgent Government contracts for tanks, aircraft, machine tools, shipbuilding, etc., and there are some foundry establishments which are as busy as they ever have been at any period of the war. A large aggregate tonnage of low- and medium-phosphorus pig-iron, refined iron and hematite is still being consumed, but the pressure of demand is certainly lighter than it was, say, at this period of last year. After the end of this month the foundries will be able to buy supplies of low-phosphorus iron and also medium-phosphorus grades from the furnaces of their choice. Neither are they limited to any particular supplier of high-phosphorus iron. The Control hopes, however, that they will buy from the nearest supplier, in order to reduce the burden on the railways as much as possible.

At the moment, hematite is the only quality of iron of which it can be said that there is any shortage. The Control still watches carefully the consumption and delivery of hematite and will authorise its acquisition only where the use of a substitute iron is impossible. High-phosphorus iron is plentiful and the light-castings trade has no difficulty in getting licensed quantities. The light foundries still find their activities somewhat closely circumscribed; some of them have recently received a few more orders for heating appliances, but this improvement is seasonal only and the light-castings trade as a whole cannot look for any big influx of orders so long as building activity remains restricted and export trade on any scale is prohibited.

Whatever anxieties may be felt in regard to future fuel supplies, there are, at present, no worries in respect of coke. Blast-furnace coke is plentiful and there are adequate supplies also of foundry grades. Iron-ore deliveries are also satisfactory and there is no difficulty in regard to limestone for cupola use.

Steelmakers are uniformly busy. There is no relaxation in the demand for steel plates, especially ship and boiler qualities, and in most cases makers are indicating well into Period I of 1944 for delivery of new orders. It is comparatively easy to get early delivery of heavy sections and joists, but the steelworks' light mills are all heavily booked. They have substantial orders in hand for medium and light sections and also for bars. Re-rollers of bars and sections have also good order-books and are under constant pressure for delivery, particularly of light sections. Bars for nut and bolt making, for forging purposes and for shipbuilding figure largely in rolling programmes. Altogether it is not easy to satisfy all demands for re-rolled steel. Stockholders, in particular, have had occasion to complain of their inability to obtain delivery of all their quarterly quota. They point out that they are not allowed to carry forward the unexpended tonnage to the next quarter and so are deprived of a portion of their turnover. Makers do their best to avoid any injustices of this kind, but sometimes the pressure for delivery from priority users is too strong. Among sheet-makers there are some very heavy orders to fulfil. Tube works and the rivet, bolt and nut makers are steady consumers of iron and steel. The collieries absorb substantial quantities of steel in the form of arches, rails and props, while the locomotive boilers and rolling-stock manufacturers are all very busy. There seems to be little falling off of activity at the steelfoundries. The demand for finished iron, although improved in recent weeks, is still within the capacity of the works to produce. There have been a good many instances where users of steel have turned over to wrought iron owing to the delay in securing delivery of the former.

NON-FERROUS METALS

Consumption of the non-ferrous metals is, in the aggregate, very large indeed, but there seems to be little doubt that consumption is lower now than it has been during the last two or three years. Possibly the approach of the end of the year may be reducing the demand for metals in scrap form. Certainly there is very little activity in the market for secondary material at the moment. There is still a lull evident in certain of the copper and brass consuming trades and whether or not this is a temporary phase is not clear at the moment. Consumers of zinc on essential work have no difficulty in securing the supplies they need and probably in this metal also there is rather more to spare than has been the case for a long time past. The Control, however, is not relaxing the tight hand it keeps on supplies and the release of metal to non-essential users would appear to be still far off. Lead is in relatively plentiful supply. Consumption for war purposes is large, but it possibly has not made up for the reduced consumption consequent on the restrictions placed on private house building. Aluminium continues to be in keen demand and every ton which becomes available finds a ready outlet to the aircraft manufacturers and other important war users.

Under the Control of Non-Ferrous Metals (No. 13) (Copper, Lead and Zinc) Order, 1943, which came into force on November 13, the maximum price of black hot-rolled copper wire rods is increased from £65 10s. to £65 15s. per ton, delivered buyers' premises. The change—the first to be made in non-ferrous metal prices for many months—is attributed to increased delivery costs.

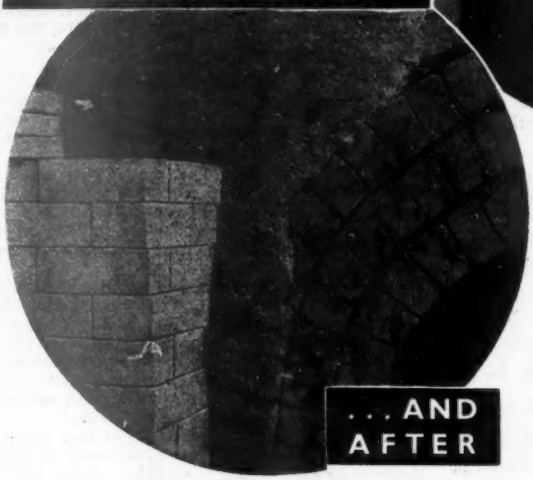
Patch

WORN FURNACE BRICKWORK WITH

Durax No. 1

PLASTIC FIREBRICK COMPOSITION

BEFORE



...AND AFTER

WHEN quick repairs to worn furnace brickwork are required, Durax No. 1 provides an excellent patching medium. It is supplied in a stiff, plastic condition ready for use. It possesses exceptionally high refractoriness, negligible shrinkage on drying, and good resistance to thermal shock.

Durax No. 1 is also frequently used as a rammed monolithic lining in small size furnaces, such as crucible furnaces, owing to the ease of installation — the avoidance of special shapes—and because it provides a strong, durable structure. Users who require further information concerning the uses of Durax No. 1 should communicate with the G.R. Technical Department.

General Refractories LIMITED

GENEFAX HOUSE, SHEFFIELD, 10

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GR

FIREBRICKS · BASIC BRICKS · ACID-PROOF MATERIALS · CEMENTS

PLASTICS · INSULATION · SILICA BRICKS · SILLIMANITE · SANDS

CURRENT PRICES OF IRON, STEEL AND NON-FERROUS METALS

(Delivered, unless otherwise stated)

Wednesday, November 17, 1943

PIG-IRON

Foundry Iron.—CLEVELAND No. 3: Middlesbrough, 128s.; Birmingham, 130s.; Falkirk, 128s.; Glasgow, 131s.; Manchester, 133s. DERBYSHIRE No. 3: Birmingham, 130s.; Manchester, 133s.; Sheffield, 127s. 6d. NORTHANTS No. 3: Birmingham, 127s. 6d.; Manchester, 131s. 6d. STAFFS No. 3: Birmingham, 130s.; Manchester, 133s. LINCOLNSHIRE No. 3: Sheffield, 127s. 6d.; Birmingham, 130s.

(*No. 1 foundry 3s. above No. 3. No. 4 forge 1s. below No. 3 for foundries, 3s. below for ironworks.*)

Hematite.—No. 1 (S & P 0.03 to 0.05 per cent.): Scotland, N.-E. Coast and West Coast of England, 138s. 6d.; Sheffield, 144s.; Birmingham, 150s.; Wales (Welsh iron), 134s. East Coast No. 3 at Birmingham, 149s.

Low-phosphorus Iron.—Over 0.10 to 0.75 per cent. P, 140s. 6d., delivered Birmingham.

Scotch Iron.—No. 3 foundry, 124s. 9d.; No. 1 foundry, 127s. 3d., d/d Grangemouth.

Cylinder and Refined Irons.—North Zone, 174s.; South Zone, 176s. 6d.

Refined Malleable.—North Zone, 184s.; South Zone, 186s. 6d.

Cold Blast.—South Staffs, 227s. 6d.

(NOTE.—*Prices of hematite pig-iron, and of foundry and forge iron with a phosphoric content of not less than 0.75 per cent., are subject to a rebate of 5s. per ton.*)

FERRO-ALLOYS

(Per ton unless otherwise stated, basis 2-ton lots, d/d Sheffield works.)

Ferro-silicon (5-ton lots).—25 per cent., £21 5s.; 45/50 per cent., £27 10s.; 75/80 per cent., £43. Briquettes, £30 per ton.

Ferro-vanadium.—35/50 per cent., 15s. 6d. per lb. of V.

Ferro-molybdenum.—70/75 per cent., carbon-free, 6s. per lb. of Mo.

Ferro-titanium.—20/25 per cent., carbon-free, 1s. 3½d. lb.

Ferro-tungsten.—80/85 per cent., 9s. 8d. lb.

Tungsten Metal Powder.—98/99 per cent., 9s. 9½d. lb.

Ferro-chrome.—4/6 per cent. C, £59; max. 2 per cent. C, 1s. 6d. lb.; max. 1 per cent. C, 1s. 6½d. lb.; max. 0.5 per cent. C, 1s. 6¾d. lb.

Cobalt.—98/99 per cent., 8s. 9d. lb.

Metallic Chromium.—96/98 per cent., 4s. 5d. lb.

Ferro-manganese.—78/98 per cent., £18 10s.

Metallic Manganese.—94/96 per cent., carb.-free, 1s. 9d. lb.

SEMI-FINISHED STEEL

Re-rolling Billets, Blooms and Slabs.—BASIC: Soft, u.t., 100-ton lots, £12 5s.; tested, up to 0.25 per cent. C, £12 10s.; hard (0.42 to 0.60 per cent. C), £13 17s. 6d.; silico-manganese, £17 5s.; free-cutting, £14 10s. SIEMENS MARTIN ACID: Up to 0.25 per cent. C, £15 15s.; case-hardening, £16 12s. 6d.; silico-manganese, £17 5s.

Billets, Blooms and Slabs for Forging and Stamping.—Basic, soft, up to 0.25 per cent. C, £13 17s. 6d.; basic hard, 0.42 to 0.60 per cent. C, £14 10s.; acid, up to 0.25 per cent. C, £16 5s.

Sheet and Tinplate Bars.—£12 2s. 6d., 6-ton lots.

FINISHED STEEL

[*A rebate of 15s. per ton for steel bars, sections, plates, joists and hoops is obtainable in the home trade under certain conditions.*]

Plates and Sections.—Plates, ship (N.-E. Coast), £16 3s.; boiler plates (N.-E. Coast), £17 0s. 6d.; chequer plates (N.-E. Coast), £17 13s.; angles, over 4 un. ins., £15 8s.; tees, over 4 un. ins., £16 8s.; joists, 3 in. × 3 in. and up, £15 8s.

Bars, Sheets, etc.—Rounds and squares, 3 in. to 5½ in., £16 18s.; rounds, under 3 in. to ½ in. (untested), £17 12s.; flats, over 5 in. wide, £15 13s.; flats, 5 in. wide and under, £17 12s.; rails, heavy, f.o.t., £14 10s. 6d.; hoops, £18 7s.; black sheets, 24 g. (4-ton lots), £22 15s.; galvanised corrugated sheets (4-ton lots), £26 2s. 6d.; galvanised fencing wire, 8g. plain, £26 17s. 6d.

Tinplates.—I.C. cokes, 20 × 14 per box, 29s. 9d., f.o.t. makers' works, 30s. 9d., f.o.b.; C.W., 20 × 14, 27s. 9d., f.o.t., 28s. 6d., f.o.b.

NON-FERROUS METALS

Copper.—Electrolytic, £62; high-grade fire-refined, £61 10s.; fire-refined of not less than 99.7 per cent., £61; ditto, 99.2 per cent., £60 10s.; black hot-rolled wire rods, £65 15s.

Tin.—99 to under 99.75 per cent., £275; 99.75 to under 99.9 per cent., £276 10s.; min. 99.9 per cent., £278 10s.

Spelter.—G.O.B. (foreign) (duty paid), £25 15s.; ditto (domestic), £26 10s.; "Prime Western," £26 10s.; refined and electrolytic, £27 5s.; not less than 99.99 per cent., £28 15s.

Lead.—Good soft pig-lead (foreign) (duty paid), £25; ditto (Empire and domestic), £25; English, £26 10s.

Zinc Sheets, etc.—Sheets, 10g. and thicker, ex works, £37 12s. 6d.; rolled zinc (boiler plates), ex works, £35 12s. 6d.; zinc oxide (Red Seal), d/d buyers' premises, £30 10s.

Other Metals.—Aluminium, ingots, £110; antimony, English, 99 per cent., £120; quicksilver, ex warehouse, £68 10s. to £69 15s.; nickel, £190 to £195.

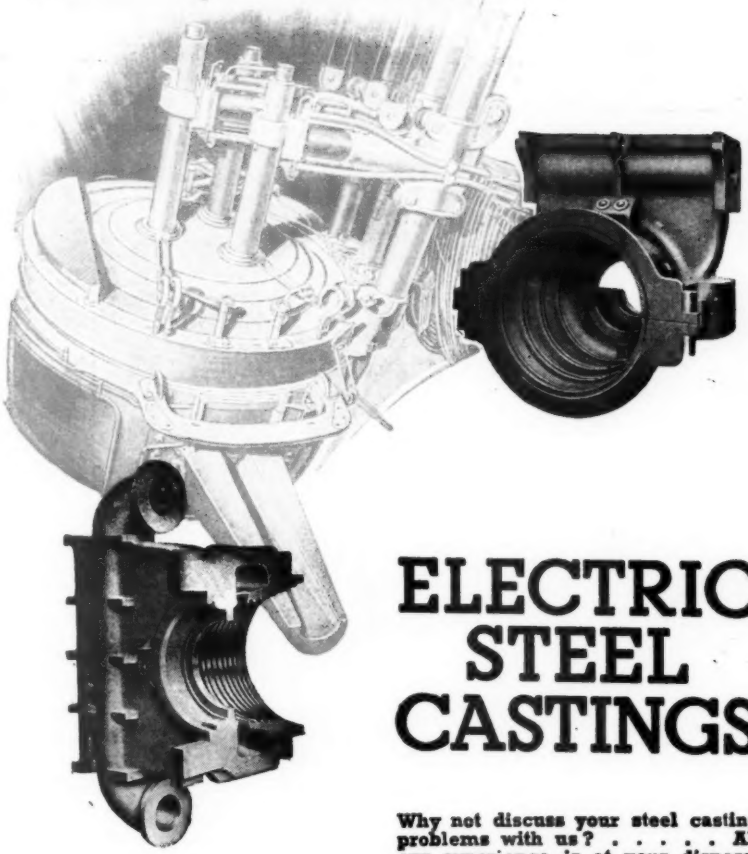
Brass.—Solid-drawn tubes, 14d. per lb.; brazed tubes, 16d.; rods, drawn, 11¾d.; rods, extruded or rolled, 9d.; sheets to 10 w.g., 10⅞d.; wire, 10¾d.; rolled metal, 10¼d.; yellow metal rods, 9d.

Copper Tubes, etc.—Solid-drawn tubes, 15½d. per lb.; brazed tubes, 15½d.; wire, 10d.

Phosphor Bronze.—Strip, 13½d. per lb.; sheets to 10 w.g., 14¾d.; wire, 16d.; rods, 16d.; tubes, 21½d.; castings, 19d., delivery 3 cwt. free. 10 per cent. phos. cop. £35 above B.S.; 15 per cent. phos. cop. £43 above B.S.; phosphor tin (5 per cent.) £40 above price of English ingots. (C. CLIFFORD & SON, LIMITED.)

Nickel Silver, etc.—Ingots for raising, 10d. to 1s. 4d. per lb.; rolled to 9 in. wide, 1s. 4d. to 1s. 10d.; to 12 in. wide, 1s. 4½d. to 1s. 10½d.; to 15 in. wide, 1s. 4½d. to 1s. 10½d.; to 18 in. wide, 1s. 5d. to 1s. 11d.; to 21 in. wide, 1s. 5½d. to 1s. 11½d.; to 25 in. wide, 1s. 6d. to 2s. Ingots for spoons and forks, 10d. to 1s. 6½d. Ingots rolled to spoon size, 1s. 1d. to 1s. 9½d. Wire round, to 10g., 1s. 7½d. to 2s. 2½d., with extras according to gauge. Special 5ths quality turning rods in straight lengths, 1s. 6½d. upwards.

from a few pounds up to **25 TONS –**



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JAMES BRIDGE STEEL WORKS, near WEDNESBURY
TELEPHONE: DARLASTON 225 (4 LINES) TELEGRAMS 'STEEL DARLASTON'

FOUNDRY TRADE JOURNAL

EST. 1902

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